IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel. W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,	)
Plaintiff,	)
vs.	) **05-CV-0329 GKF-SAJ**
TYSON FOODS, INC., TYSON POULTRY, INC., TYSON CHICKEN, INC., COBB-VANTRESS, INC., AVIAGEN, INC., CAL-MAINE FOODS, INC., CAL-MAINE FARMS, INC., CARGILL, INC., CARGILL TURKEY PRODUCTION, LLC, GEORGE'S, INC., GEORGE'S FARMS, INC., PETERSON FARMS, INC., SIMMONS FOODS, INC., and WILLOW BROOK FOODS, INC.,	)
Defendants.	)

DECLARATION OF FRANK J. COALE, Ph.D.
November 26, 2008

1. Introduction
   a. I, Frank J. Coale, earned a B.S. degree in Agronomy from the University of Maryland in 1981. I then continued on for graduate study at the University of Kentucky where I earned a M.S. degree in Crop Physiology in 1983 and a Ph.D. in Soil Fertility and Plant Nutrition in 1986. I was employed as Assistant Professor of Agronomy at the University of Florida, Everglades Research and Education Center, from 1986 until 1991. In 1991, I was promoted to Associate Professor with tenure at the University of Florida, where I was employed until 1993. At that time, I was hired as Associate Professor of Soil Science, with tenure, at the University of Maryland. In 2002, I was promoted to Professor of Soil Science. In 2005, I became Department Chair for the Department of

Natural Resource Sciences and Landscape Architecture at the University of Maryland. In 2006, I was appointed the inaugural Chair of the University of Maryland's newly formed Department of Environmental Science and Technology. Currently, I am Professor of Soil Science and Department Chair of the Department of Environmental Science and Technology, University of Maryland. Details of my education and employment history are included in the attached curriculum vitae.

b. Over my professional career, I have edited one book, written six book chapters, and published 48 refereed journal publications. I also have written 163 Extension education publications for a variety of audiences. Details of my publication record are included in the attached curriculum vitae.

c. I have delivered 52 invited professional presentations and 80 volunteered presentations at numerous professional society meetings. Additionally, I have given 167 general Extension education talks to a wide variety of lay audiences and 277 professional technical training sessions in the area of soil fertility, nutrient management and plant nutrition. Details of my professional presentations are included in the attached curriculum vitae.

d. I have served as academic advisor to 25 graduate students (15 M.S., 10 Ph.D.) and have supported my research and extension programs with over $11 million in external grant support. Details of my graduate student advising and grants are included in the attached curriculum vitae.

2. Professional Service
   a. I have been retained by the defendants in this case to offer professional opinions on a variety of topics within my area of professional expertise. For such services, I require compensation at the rate of $250/hour, plus reimbursement of direct expenses.

3. Poultry litter as a source of plant nutrients
   a. For some farming operations, poulty litter is a readily available and relatively inexpensive source of plant nutrients that can be used to satisfy crop nutrient requirements. Poultry litter contains each of the sixteen nutrient elements that are essential for plant growth: carbon (C) , hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), iron (Fe), boron (B), manganese (Mn), zinc (Zn), copper (Cu), molybdenum (Mo), chlorine (Cl). Although C, H, and O are sequestered by plants from the atmosphere through photosynthesis, the remaining thirteen essential nutrient elements are acquired from the soil by plant roots. In order for plants to grow efficiently and maximize biomass production, an adequate supply of each of the thirteen soil-derived essential nutrients must be available for plant uptake within the root zone. The thirteen soil nutrient elements are frequently categorized into three groups based on the relative quantity of each nutrient required by the plant:

      Macronutients – N, P, K
      Secondary nutrients – Ca, Mg, S
      Micronutrients – Fe, B, Mn, Zn, Cu, Mo, Cl.

additions, and liming benefits derived from poultry litter applications.

j. Elemental P does not exist as a isolated element in nature. Additionally, unreacted phosphoric acid (H_3PO_4) exists only under laboratory conditions where H^+ is the only cation present. I am in agreement with Dr. Gordon Johnson's summary of the "Behavior of Phosphorus in Soils and the Environment" (Section 3a, Expert Report of Gordon V. Johnson, Ph.D., May 13, 2008) that stated that elemental P does not exist in nature and the unreacted phosphoric acid does not exist in the natural soil environment.

k. Accordingly, neither elemental P nor phosphoric acid are constituents of poultry litter. Neither elemental P nor phosphoric acid are products of poultry litter decomposition and mineralization following land application to agricultural production fields.

l. I have conducted research utilizing poultry litter and studied the academic literature on poultry litter for over 15 years. I reviewed the list of elements, chemicals and compounds claimed to be components of poultry litter that was presented in the Expert Report of Roger Olsen (Section 6.4.3.5 "Hazardous Substances in Poultry Waste"). Based on my experience and knowledge of the pertinent literature, the following are entries listed in the Expert Report of Roger Olsen, Section 6.4.3.5, that are not typically found in routine analysis of poultry litter from commercial poultry production facilitites. My opinion is based on my personal knowledge, professional expectations, and recollection of the literature pertaining to typical commercial poultry litter.

Cadmium and compounds
Nitric acid
Nitrosamines
Phosphoric acid
Polynuclear aromatic hydrocarbons
Radionuclides
Sulfuric acid
Thiourea
Unlisted hazardous waste with characteristics of reactivity

4. Poultry litter use in a pasture-based beef cattle production system

a. Nitrogen is typically the largest input nutrient required for management of pasture grasses used in a pasture-grazed beef cattle production system. Nitrogen fertilizer application rates are based on forage production potential or pasture yield goal. Realistic forage crop yield goals are determined by forage species grown, pasture density, soil type, climate, and management expertise. Historical production records are usually used to determine future yield goals. Recommended application rates for other crop nutrients and soil amendments (P, K, lime, etc.) are based on established soil testing procedures.

b. Poultry litter from the cleanout of poultry houses may be an economical source of fertilizer nutrients to support the pasture grasses for beef cattle production . Historically, litter applications to grass pastures usually have been based on the N fertilization rate needed to achieve a forage production goal. Even if soil-test P levels are adequate, N must be applied to maintain pasture productivity. Poultry litter may be the most